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(54) Continuous security alarm for current consuming equipments

(57) This security alarm protects electrical current consuming equipments, giving an audible warning when the equipment is removed from the source of electrical current. The alarm will not occur because of a power cut but will occur at all times if the power lead is cut or removed from the source of electrical current. The alarm can be made to monitor single equipments or several equipments and can have an output for triggering other security systems.

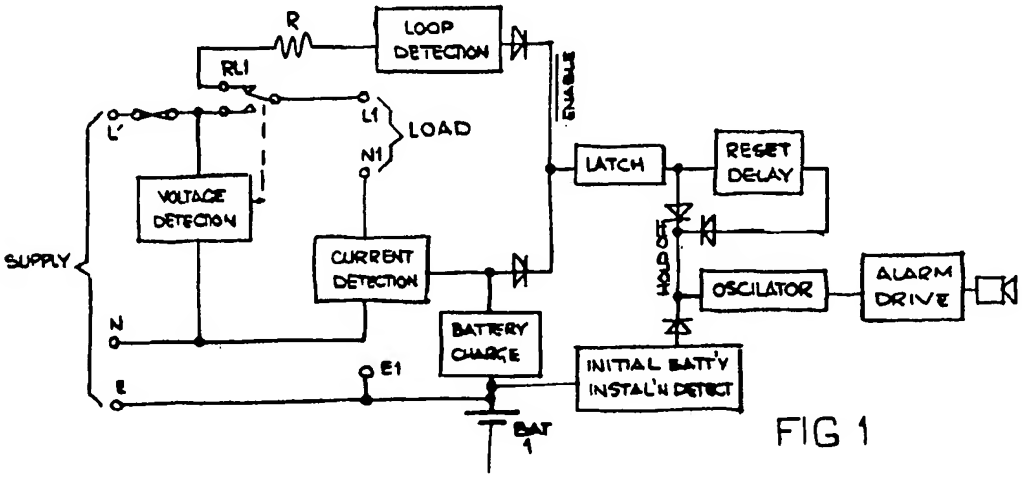

FIG 1

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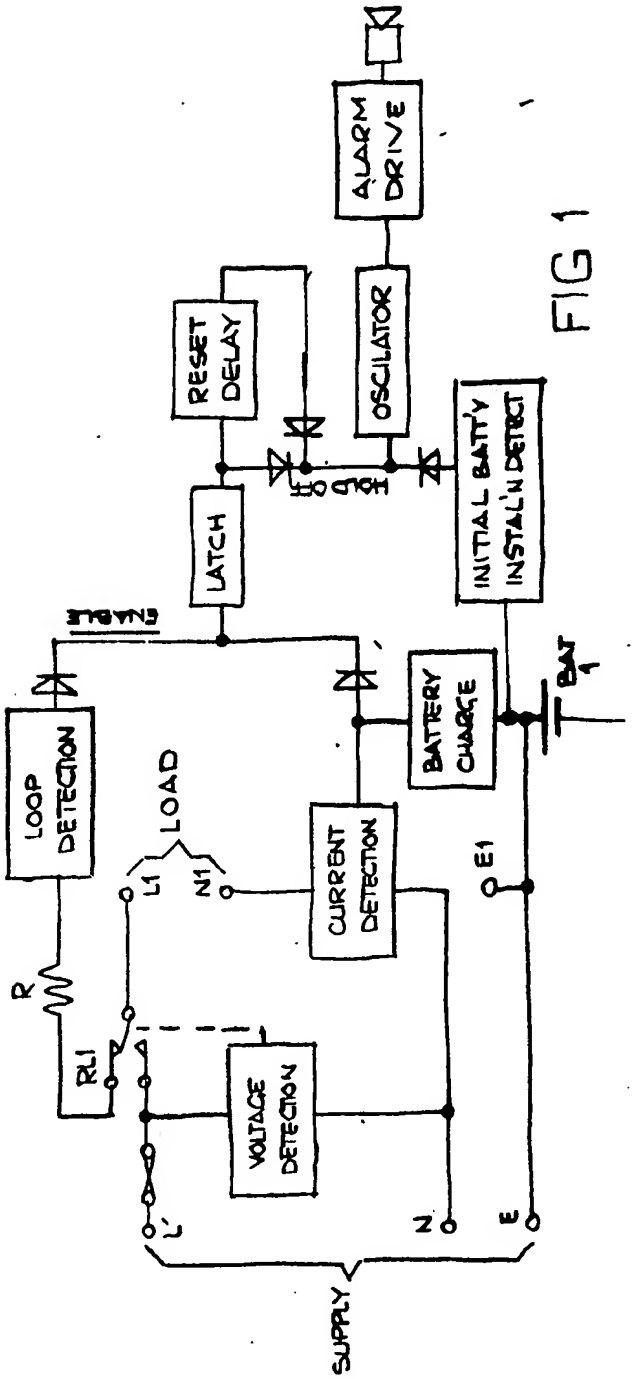
ALARM DRIVE
OSCILATOR
RESET DELAY
LATCH
INITIAL BATT'Y INSTAL'N DETECT
BATTERY CHARGE
BAT 1
LOOP DETECTION
LOAD
L1
N1
CURRENT DETECTION
E1
R
RL1
VOLTAGE DETECTION
L'
N
E
SUPPLY

FIG 1

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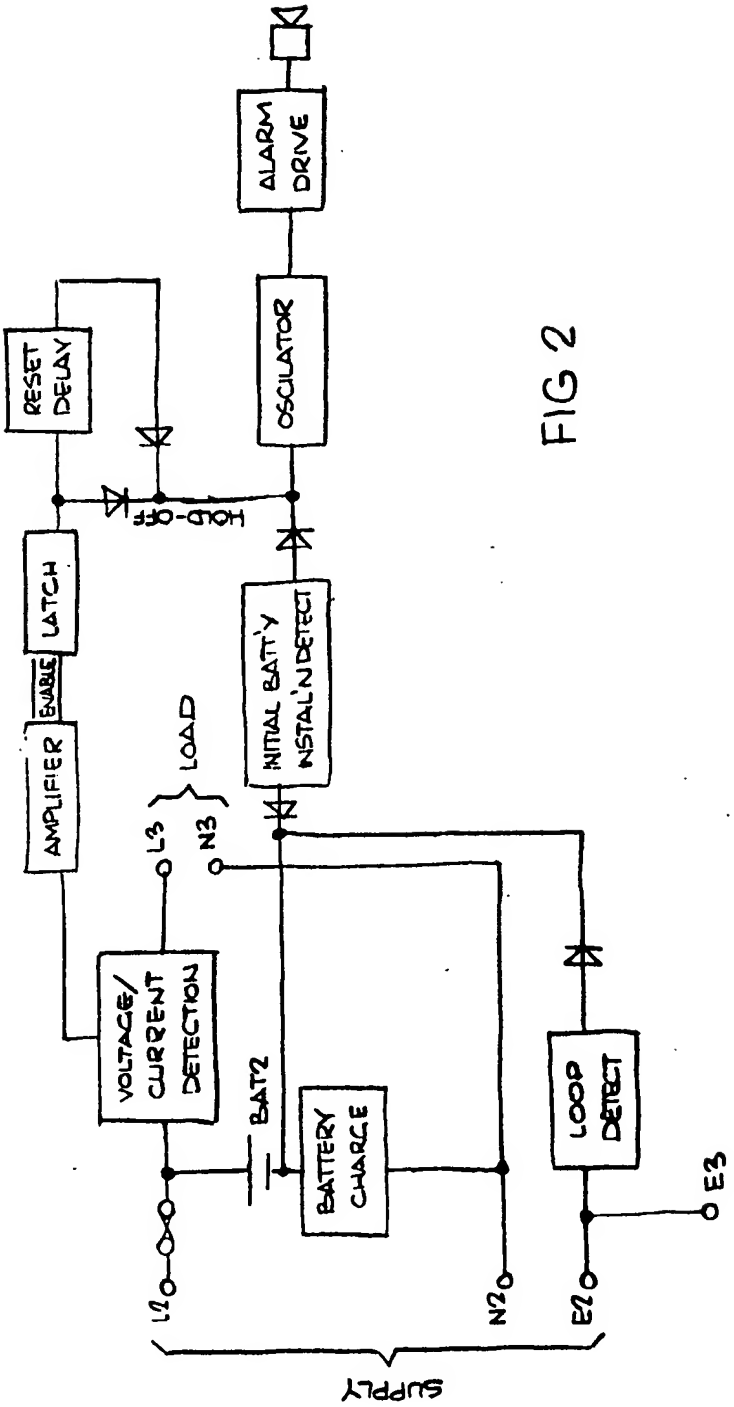

FIG 2

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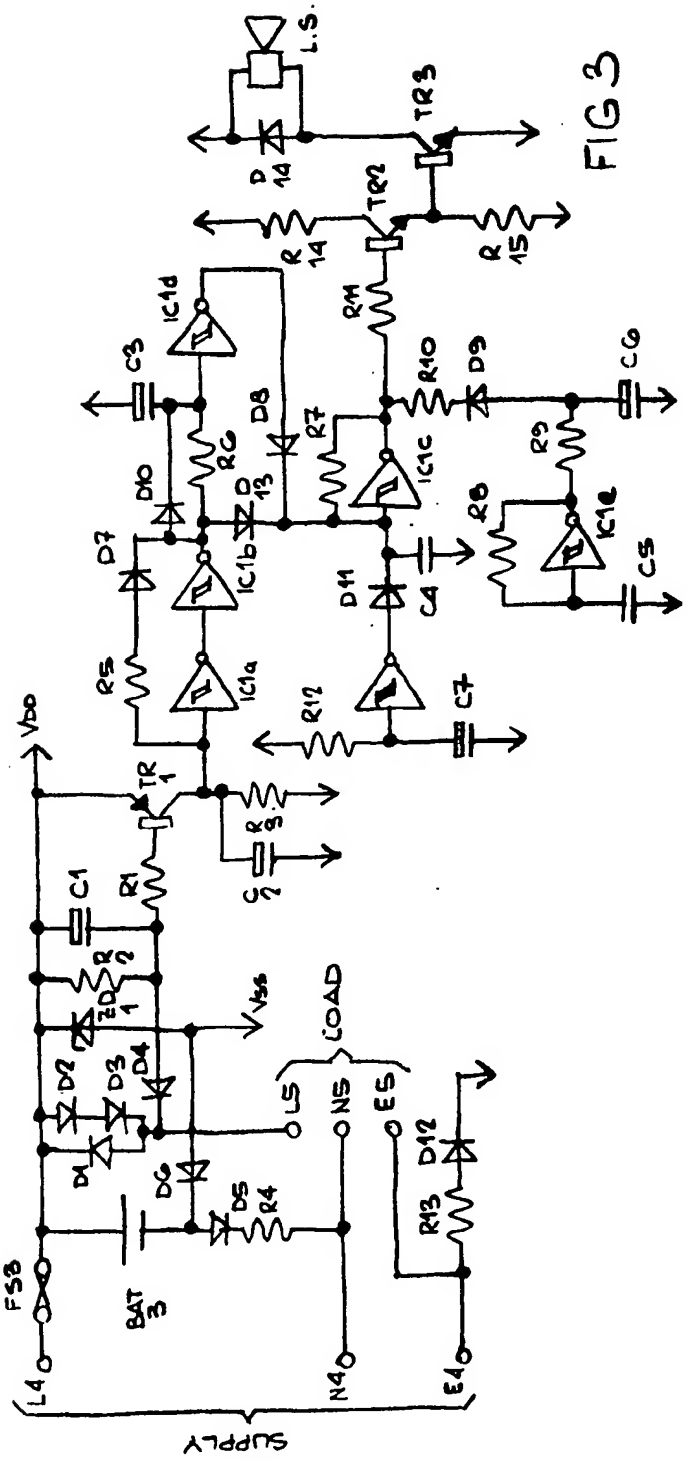

FIG 3

SPECIFICATION

Continuous security alarm for current consuming equipments

This invention relates to the protection of electrical current consuming equipments, and gives audible warning when the equipment is disconnected from the source of electrical current.

With the increasing use of sophisticated portable electronic equipments in the home and in industry there is an ever increasing risk of theft. Protection therefore is increasingly required.

The invention consists of a self contained electronic circuit which is mounted onto a printed circuit board. This board can be mounted into a box which connects in series with the equipments incoming power cable. The circuit gives an audible warning if:–

(a) the power lead is removed

(b) the power lead is cut before or after the box

Operation is achieved via a self contained rechargable battery and therefore protection is provided when the power is switched off at the socket or a power cut has occurred.

A specific embodiment of the invention is described by way of examples with reference to the accompanying drawings in which:–

Figure 1 shows the basic block diagram, this contains circuitry originally described in Patent Application 8313366.

Figure 2 shows an alternative block diagram based on the principles of Fig. 1.

Figure 3 shows a functional circuit diagram.

Referring to the drawing Fig. 1, the incoming supply is labelled L, N, E. A voltage detection circuit detects the presence of mains voltage at the incoming terminals. If voltage is present then the relay contacts (RL1) are changed over and the voltage is applied to the load terminals L1 and N1. If the load is present then current will flow and this is detected by the current detection circuit. When voltage ceases to be pesent then the relay contacts (RL1) are changed over, and the loop detection circuit monitors, that the load is in series with the neutral and earth link, this being achieved by connecting the + terminal of the battery (BAT1) to the earth conductor. If the current detection and loop detection are removed then the latch will be enabled and thus the hold off signal will be removed and oscillator will drive the alarm drive circuit. In order to conserve power in the battery and remove continual annoyance a reset timer will restore the hold off signal after a period of time. In order to enable initial connection of the invention without causing an alarm a Battery Detection circuit is provided. This gives a hold off signal for a period of time when the battery is initially installed thus enabling connection to the mains supply. Re-setting the latch can only be achieved by the current detection circuit. Resistor R ensures that only this can occur and also limits the current in the earth path to well below detectable limits.

Reference to the drawing Fig. 2, the incoming supply is labelled L2, N2, E2. A rechargable battery BAT2 is charged via the battery charge circuit. A Voltage/Current detection circuit detects the presence of current flow through the electrical equipment connected to terminals L3, N3, E3. The output of the current detection is taken to the amplifier. If the voltage at the incoming supply L,N, E is removed by a power cut or by switching off the fixed supply then battery BAT2 will supply sufficient current to the Voltage/Current detection circuit via the neutral earth link and the loop detection circuit. If therefore, the plug is removed from the fixed supply or the cable to the electrical equipment is cut then the voltage/current detection circuit will fail to provide the drive to the amplifier. The output of the amplifier normally ensures that the latch is not enabled. Therefore when the voltage/current detection circuit fails the latch changes state and removes the oscilator hold off, this in turn drives the audible alarm. In order to conserve power in the battery and remove continual annoyance a reset timer circuit will restore the hold off signal after a period of time. Connection of the invention initially is achieved by installation of the battery after all other preparations have been completed. A Battery Detection circuit ensures hold off of the alarm during the final assembly.

Fig. 3 shows a functional circuit for the block diagram shown in Fig. 2. The incoming supply is connected to L4, N4, E4 and the load to L5, N5, E5. The supply is L4 is taken to the battery (BAT 3) and via fuse FS3. The battery (BAT 3)–is taken to the supply N4 via diode D5 and resistor R4 in order to provide the recharging of BAT3. Diodes D1, D2 and D3, are connected in series with the supply and the load. With the electrical equipment connected and the fixed supply connected there is a voltage developed accross D1, D2 and D3 when current flows. Diode D4 ensures the polarity of this voltage, and capacitor C1 removes the ripple to ensure approx 0.8V. This voltage is used to operate transistor TR1 via base resistor R1. Resistor R2 provides a leakage path for C1 when current through D2 and D3 ceases. The collector of TR1 is connected to resistor R3 and capacitor C2. The opposite ends of R3 and C2 are connected to the battery (BAT 3)–via blocking diode D6. Therefore when current through D2 and D3 ceases the state of the signal to the latch made from IC1a abd IC1b will change. However C2 ensures that there is a delay to the change in state to allow for momentary loss through lightning strikes etc. and additionally

will cause a greater shock to the would be thief by delaying the audible noise by a second or so. Once the latch IC1a and IC1b has been triggered then it is held on by the output of IC1b through R5 and D7. The output of th IC1b removes the hold off from the oscilator IC1c, plus it provides the charge current for C3 via R6 which will eventually change the state of the input to IC1d, the output of which will restore the hold off to IC1c via diode D8. The oscilator made from IC1c, C4 and R7 is frequency modulated by the circuit made up from IC1e, C5, R8, R9, C6, D9, R10. This modulated frequency is fed to the base of TR2 via R11 and amplified. Diode D10 provide rapid discharge of C4. On initial installation of the battery BAT3 the output of IC1f provides the hold off via diode D11. C7 is charged through R12 and eventually changes the input state of IC1f and thus removes the hold off via D11. The voltage generated accross D2 and D3 will be removed if:–

(a) The electricity consuming equipment cable is cut

(b) The link between N4 and E4 is broken, e.g. by removal of plug from fixed supply.

When there is a power failure or the fixed socket is switched off then the voltage accross D2 and D3 is present due to the resistor R13 and blocking diode D12. The value of R13 is chosen to ensure currents are well below detectable earth leakage limits.

Additional security could be provided by fitting an anti-tamper switch to the box and allowing this to operate the latch.

The circuit could equally be built into a standard wall socket, thus providing a fixed means of protection.

Equally the circuit could be arranged to provide current monitoring etc of several equipments. If this is linked to a keyswitch a means would be provided to enable selection of fitted equipments if say all equipments were not fitted.

Further circuitry could be added to ensure that once the latch has been triggered then it could not be reset until a fixed time period has passed.

The output alarm drive could in addition energise a relay whose contacts could be connected into any other security system.

CLAIMS

1. A security device for protecting electrical current consuming equipment, comprising a mains input and output for the protected equipment, battery powered control circuit driving an audible sound generator when there is a loss of voltage or current through the detection circuit because of the protected equipments cable being cut or the protected equipments connection to the fixed supply being removed.

2. A security device according to claim 1 mounted in a fixed wall socket.

3. A security device according to claim 1 mounted in a plug for insertion into a fixed wall socket.

4. A security device according to claim 1 mounted within a box to be inserted into the protected equipment's supply cable.

5. A security device according to claim 1 mounted within the equipment to be protected.

6. A security device according to claim 2 but monitoring several equipment circuits.

7. A security device according to claim 3 but monitoring several equipment circuits.

8. A security device according to claim 4 but monitoring several equipment circuits.

9. A security device according to claim 1 but having an additional output connected to any other security system.

10. A security device substantially as described here-in, with reference to and as Fig. 1 of the accompanying drawings.

11. A security device substantially as described here-in, with reference to and as Fig. 2 of the accompanying drawings.

12. A security device substantially as described here-in, with reference to and as Fig. 3 of the accompanying drawings.

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